U.S. Department of Transportation
Federal Highway Administration

1200 New Jersey Ave., SE
Washington, D.C. 20590

August 19, 2011

In Reply Refer To:
HSST/CC-102A

Mr. Gerrit A. Dyke. P.E.
Vice President of Engineering and R & D
Barrier Systems, Inc.
3333 Vaca Valley Parkway, Suite 800
Vacaville, CA 95688

Dear Mr. Dyke:

This letter is in response to your request for Federal Highway Administration (FHWA) acceptance of a roadside safety system for use on the National Highway System (NHS).

Name of system:	X-Tension Terminal at 31-inch (787-millimeter) height
Type of system:	Tangent & Flared Re-directive W-Beam Terminal
Test Level:	NCHRP Report 350 TL-3
Testing conducted by:	Safe Technologies Inc.
Date of request:	December 20, 2010
Request acknowledged:	December 27, 2010
Task Force 13 Designator:	SEW19b Tangent SEW20b Flared

You requested that we find this system acceptable for use on the NHS under the provisions of the National Cooperative Highway Research Program (NCHRP) Report 350 "Recommended Procedures for the Safety Performance Evaluation of Highway Features."

Requirements
Roadside safety devices tested prior to January 1, 2011 should meet the guidelines contained in NCHRP Report 350; those tested after that date must follow the guidelines contained in the American Association of State Highway and Transportation Officials' (AASHTO) Manual for Assessing Safety Hardware (MASH). The FHWA Memorandum "Identifying Acceptable Highway Safety Features" of July 25, 1997 provides further guidance on crash testing requirements for longitudinal barriers.

Decision
The following system design was found acceptable, with details provided below:

- X-Tension Terminal at 31-inch (787-millimeter) height

FHWA: HSST: WLongstreet: ms: x60087:8/18/11
File: h://directory folder/HSST/C102A.docx
cc: HSST Will Longstreet

Description
The original X-Tension end terminal was tested and accepted for use on the NHS in FHWA Acceptance Letter CC-102 for tangent, flared, and median applications. This earlier testing was done with the terminal set to match a guardrail height of 27 5/8 inches (702 millimeters). This request is for acceptance of the X-Tension set at a height of 31 inches (787 millimeters) to match the guardrail when installed at the higher height. The only changes made to the original X-Tension design were a reduction of the post embedment depths for posts #2 through #7 and the use of a longer Post #1 top section. The general layout of the flared, tangent, and median X-Tension designs and a dimensioned drawing of the longer post are shown in Enclosures 1and 2, respectively.

Crash Testing
The required crash testing was developed in consultation with the FHWA's Office of Safety Design and one test was conducted to validate the crashworthiness of the modified design. NCHRP Report 350 Test 3-34 was run on the flared layout of the X-Tension Terminal. This test was selected to address the highest occupant risk condition where the potential for small vehicle underride and maximum vehicular contact with the strong posts of the X-Tension are maximized. The cable anchor system extending from the impact head to the ground reduces the likelihood of the small car under riding the terminal in a head-on impact, and the increased height throughout the entire terminal can be expected to capture larger vehicles with little probability of override.

Test 3-34 with the 820C vehicle impacting the side of the system at the critical impact point (CIP) at a 15-degree angle was conducted using the flared X-Tension design at the 787-millimeter (31-inch) height. The CIP was determined to be upstream from Post #2. Enclosure 3 is a summary of the crash conditions and results.

Findings
You requested FHWA acceptance of the X-Tension Terminal as an NCHRP Report 350 TL-3 Redirective W-Beam Terminal:

- X-Tension Tangent End Terminal with a 0 to 300-millimeter (0 to 1-foot) offset at a 787-millimeter (31-inch) rail height.

- X-Tension Flared End Terminal with an offset up to and including 1220 millimeters (48 inches) over 11.4 meters (37.5 feet) at a 787-milimeter (31-inch) rail height.

- X-Tension Median End Terminal at a 787-millimeter (31-inch) rail height.

These options are acceptable for use on the NHS under the range of conditions tested, when such use is acceptable to a highway agency.

Please note the following standard provisions that apply to FHWA letters of acceptance:

- This letter includes an AASHTO/ARTBA/AGC Task Force 13 designation that should be used when drafting new or revised Task Force 13 drawings.

- This acceptance is limited to the crashworthiness characteristics of the systems and does not cover their structural features, nor conformity with the Manual on Uniform Traffic Control Devices.
- Any changes that may adversely influence the crashworthiness of the system will require a new acceptance letter.
- Should the FHWA discover that the qualification testing was flawed, that in-service performance reveals unacceptable safety problems, or that the system being marketed is significantly different from the version that was crash tested, we reserve the right to modify or revoke our acceptance.
- You will be expected to supply potential users with sufficient information on design and installation requirements to ensure proper performance.
- You will be expected to certify to potential users that the hardware furnished has essentially the same chemistry, mechanical properties, and geometry as that submitted for acceptance, and that it will meet the crashworthiness requirements of the FHWA and the NCHRP Report 350.
- To prevent misunderstanding by others, this letter of acceptance is designated as number CC-102A and shall not be reproduced except in full. This letter and the test documentation upon which it is based are public information. All such letters and documentation may be reviewed at our office upon request.
- The X-Tension Terminal system is a patented product and considered proprietary. If proprietary systems are specified by a highway agency for use on Federal-aid projects, except exempt, non-NHS projects, (a) they must be supplied through competitive bidding with equally suitable unpatented items; (b) the highway agency must certify that they are essential for synchronization with the existing highway facilities or that no equally suitable alternative exists; or (c) they must be used for research or for a distinctive type of construction on relatively short sections of road for experimental purposes. Our regulations concerning proprietary products are contained in Title 23, Code of Federal Regulations, Section 635.411.
- This acceptance letter shall not be construed as authorization or consent by the FHWA to use, manufacture, or sell any patented system for which the applicant is not the patent holder. The acceptance letter is limited to the crashworthiness characteristics of the candidate system, and the FHWA is neither prepared nor required to become involved in issues concerning patent law. Patent issues, if any, are to be resolved by the applicant.

Sincerely yours,

Michael S. Griffith
Director, Office of Safety Technologies
Office of Safety

U.S. Department of Transportation
Federal Highway Administration

1200 New Jersey Ave., SE
Washington, D.C. 20590

August 19, 2011

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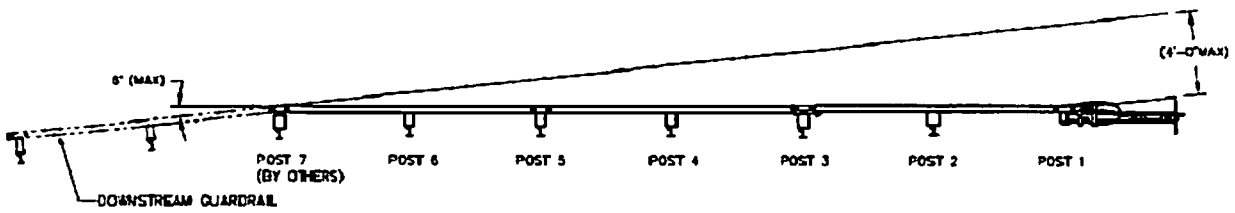
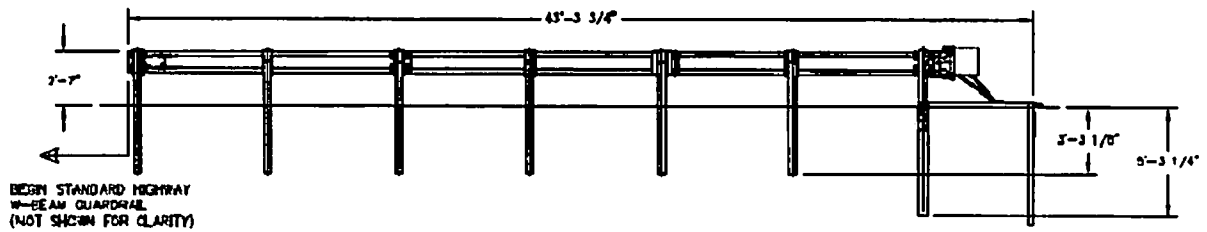
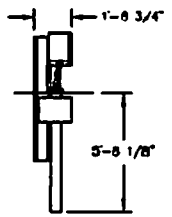
Sincerely yours,

Michael S. Griffith
Director, Office of Safety Technologies
Office of Safety

Enclosure 1 (1 of 3)







X-TENSION GUARDRAIL TERMINAL SYSTEM, 31" RAIL HEIGHT, WOOD BLOCKOUT TO STEEL POST FLARED

NOTES: UNLESS OTHERWISE SPECIFIED
1. X-TENSION SYSTEM TO BE INSTALLED PER MANUFACTURER INSTRUCTIONS.

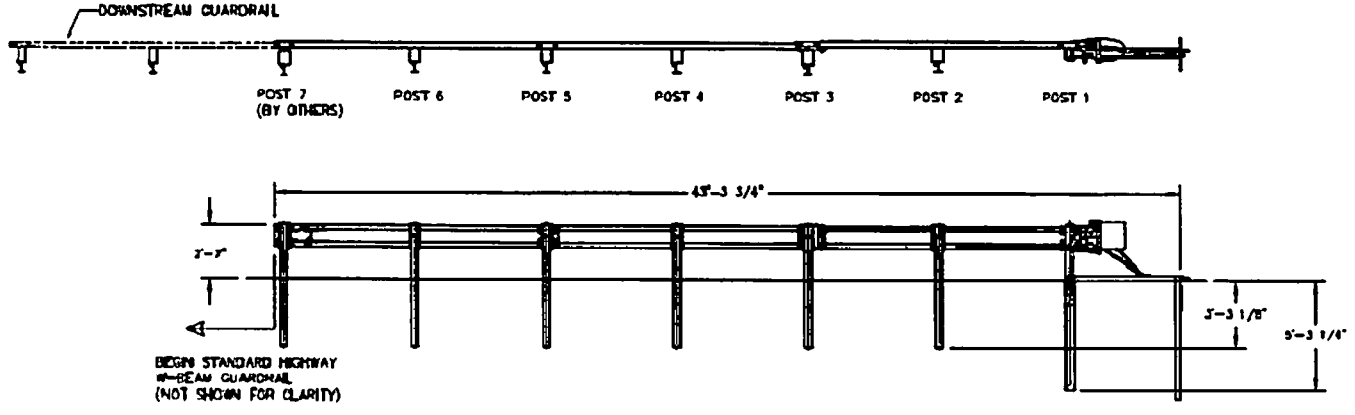
APPROVALS						
DRAWN BY: JMT						
DRAWN DATE: 12/28/10						
APPR'D BY:						
APPR'D DATE:	DO NOT SCALE DRAWING	REV	ECN#	DATE		

TITLE: X-TENSION SYSTEM , 31" RAIL HEIGHT FLARED

SIZE: B | DWG NO.: BSI-1007023-US | REV: 0

SCALE: 1:60 | SHEET: 1 OF 3

Enclosure 1 (2 of 3)



X-TENSION GUARDRAIL TERMINAL SYSTEM, 31" RAIL HEIGHT, WOOD BLOCKOUT TO STEEL POST, TANGENT

NOTES: UNLESS OTHERWISE SPECIFIED
1. X-TENSION SYSTEM TO BE INSTALLED PER MANUFACTURER INSTRUCTIONS.

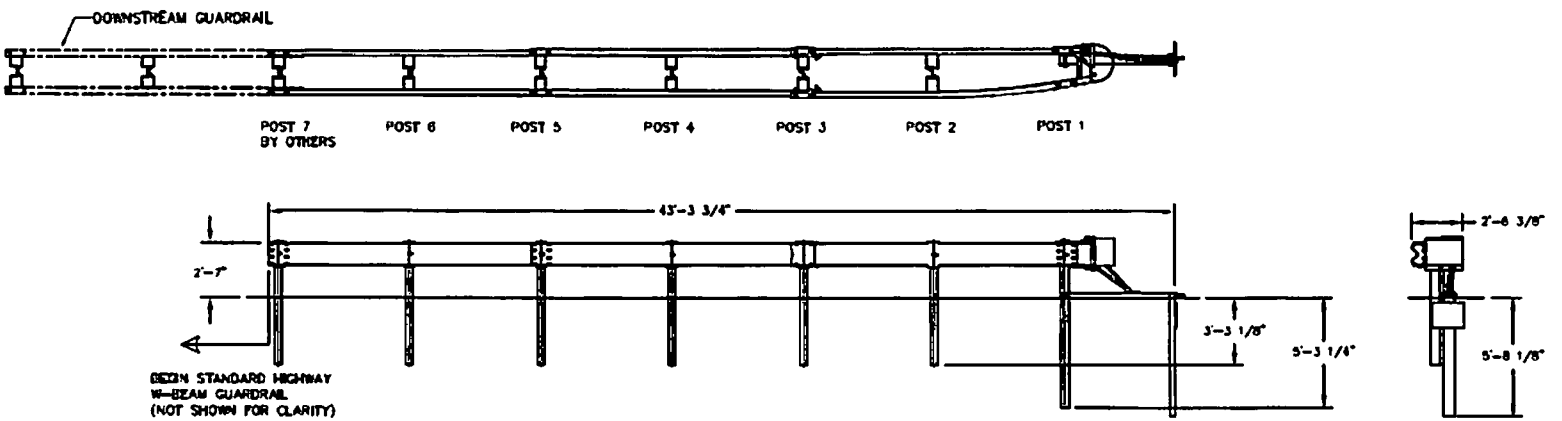
APPROVALS				
DRAWN BY: JMT				
DRAWN DATE: 12/28/10				
APVD BY				
APVD DATE	36 INT SOLE SHEET	REV	ECN#	DATE

TITLE: X-TENSION SYSTEM , 31" RAIL HEIGHT TANGENT

SIZE	DWG NO.	REV.
B	BSI-1007023-US	0

SCALE: 1:60 SHEET 2 OF 3

Enclosure 1 (3 of 3)



X-TENSION MEDIAN TERMINAL SYSTEM, 31" RAIL HEIGHT, WOOD BLOCKOUT TO STEEL POST, MEDIAN

NOTES: UNLESS OTHERWISE SPECIFIED
1. X-TENSION SYSTEM TO BE INSTALLED PER MANUFACTURER INSTRUCTIONS.

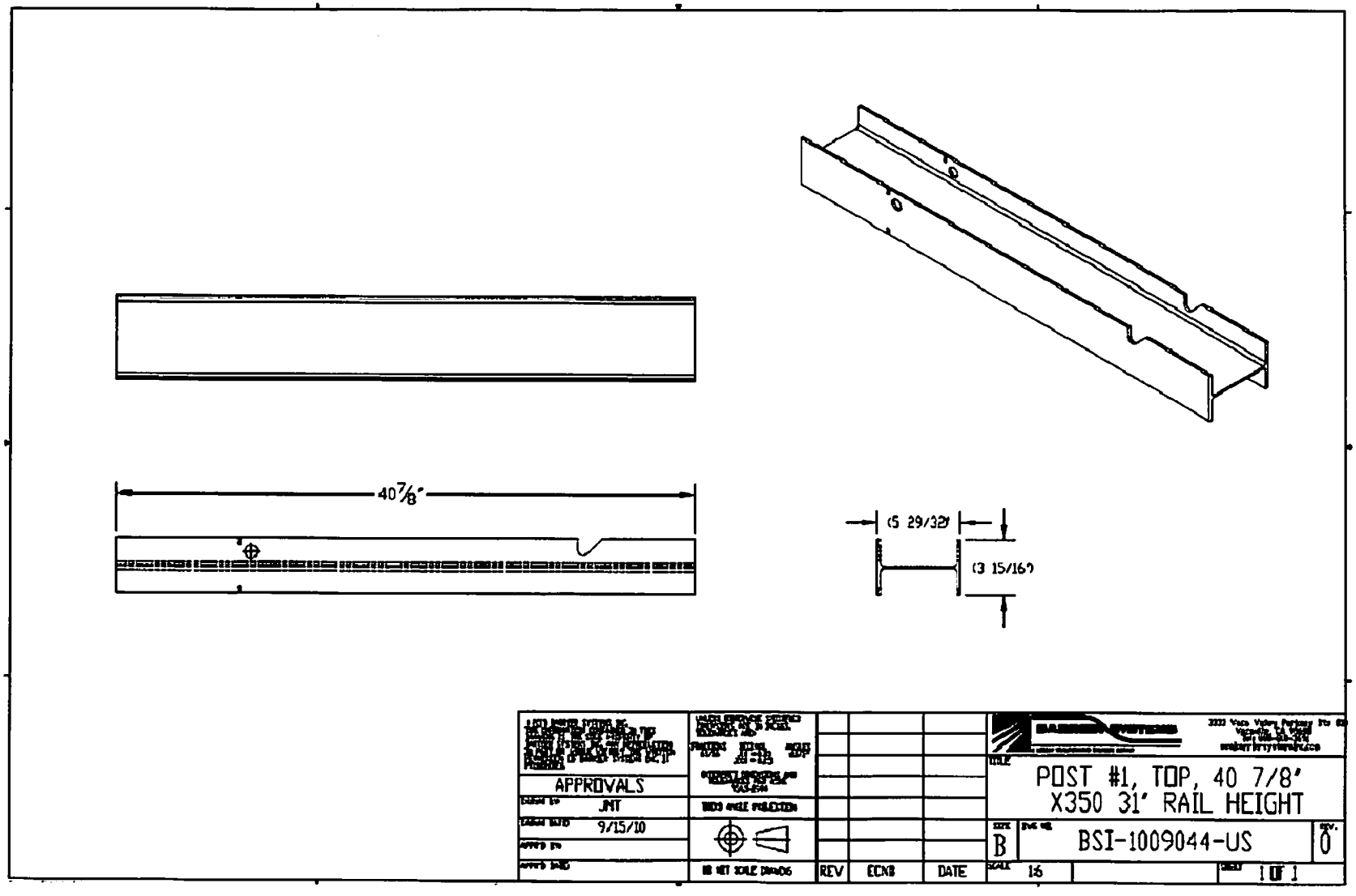
APPROVALS						
DRAWN BY: JMT						
DRAWN DATE: 12/28/10						
APPVD BY:						
APPVD DATE:	DO NOT SCALE DRAWING	REV	ECN#	DATE		

TITLE: X-TENSION SYSTEM , 31" RAIL HEIGHT MEDIAN

SIZE	DWG NO.	REV
B	BSI-1007023-US	0

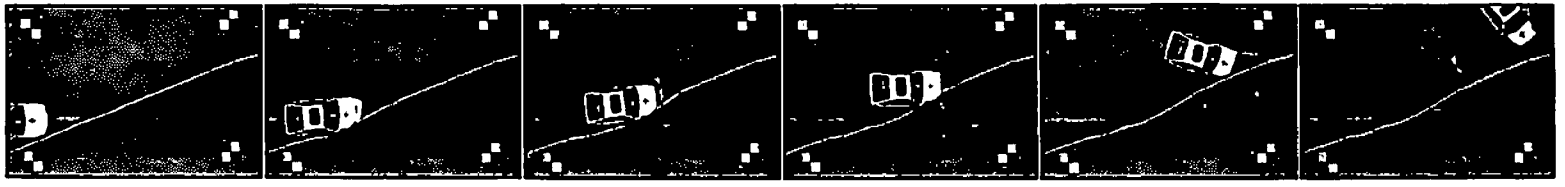
SCALE: 1:60 SHEET: 3 OF 3

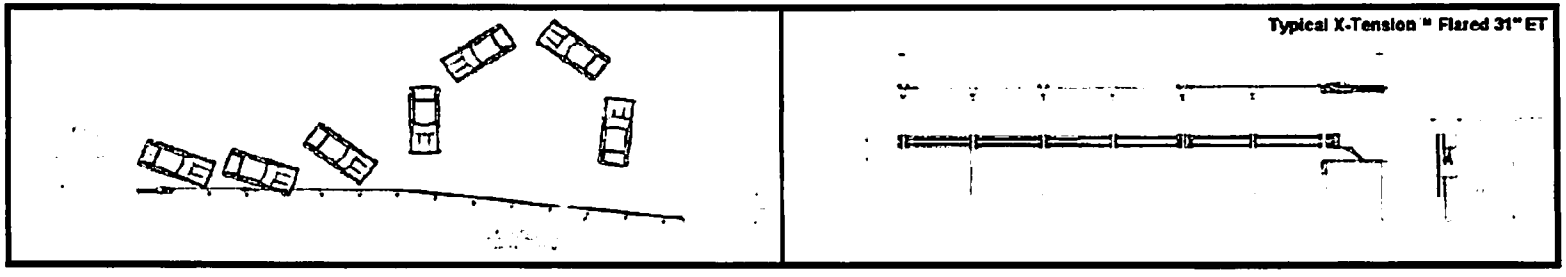
Enclosure 2



APPROVALS					TITLE: POST #1, TOP, 40 7/8' X350 31' RAIL HEIGHT	
DRAWN BY: JNT					SIZE: B	DWG NO: BSI-1009044-US
DRAWN DATE: 9/15/10					SCALE: 16	SHEET: 1 OF 1
APPD BY:						
APPD DATE:	DO NOT SCALE DRAWING	REV	ECN#	DATE		

Enclosure 3





General Information

Test Agency ..... SAFE TECHNOLOGIES, INC.
Test Designation ..... NCHRP Report 350 3-34
Test No ..... STI Test # XTF01
Date 10/22/2010

Test Article

Type ..... End Terminal
Name ..... X-Tension Flared 31"
Dimensions ..... Length: 13.2 m (43.3 ft)
Size and/or dimension and material ..... Height: 700 mm (31.0 in)
of key elements ..... Width: 526 mm (21.0 in)

Test Vehicle

Type ..... Production Model
Designation 820C
Model ..... 1987 Honda CRX
Mass (kg)
Curb 823
Test Inertial 830
Dummy(s) 75
Gross Static 905

Impact Conditions

Speed (kph) 99
Angle (deg) ..... 15 (21° with 6° flare)
Impact Severity (kJ) 21.1

Exit Conditions

Speed (kph) 50
Angle (deg) ..... 16 (22° with 6° flare)

Occupant Risk Values

Impact Velocity (m/s)
x-direction 8
y-direction 5
Ridedown Acceleration (g's)
x-direction 9
y-direction 8

Test Article Deflection (mm)

Dynamic 570
Permanent 320

Vehicle Damage

Exterior
VDS 1-RTQ-4
CDC 01FREN1
Interior
OCDI RF0000000

Post-Impact Vehicular Behavior (deg - gyro @ c.g)

Maximum Roll Angle 22
Maximum Pitch Angle 12
Maximum Yaw Angle 76